SCIENCE.

FRIDAY, JUNE 25, 1886.

COMMENT AND CRITICISM.

NEW HAMPSHIRE is more frequently visited by earthquakes than any other New England state; area for area, it is probably more often shaken than any other part of the United States east of the Rocky Mountains: but we have as yet very little definite information about its shocks. It is probable, from recent studies, that the area affected by a single disturbance is much larger than has been supposed. Systematic collection of records for a number of years is needed; and to this end, members of the Appalachian Mountain club have recently been urged by Mr. W. M. Davis of Cambridge to interest residents in New Hampshire, and elsewhere in New England, to report promptly any earthquake they may feel, noting its date, time (accurately), duration (in seconds), sound, and relative violence (very light, light, moderate, strong, or severe). On the receipt of such report, assistance will be given by the U. S. geological survey to trace the extent of the area affected.

SOME OF THE DIFFICULTIES of forest-culture in the British empire were well brought out at the meeting, May 4, of the select committee of the house of commons, appointed on the motion of Sir John Lubbock to take evidence upon the subject of forestry, with a view to the desirability of establishing a school of forestry. Dr. Sclieh, director-general of Indian forestry administration, in answer to Sir John Lubbock, said that there was a fair field for investing a certain amount of capital in woodland, provided the woods were planted on surplus lands, and not on lands required for agriculture. He did not believe that lands which could be made useful for agriculture would yield the same terms if put in woodland. There was a considerable quantity of waste land in that country which could be set aside for woodland without infringing upon the land required for agriculture. The establishment of a school of forestry would be most valuable, because it would disseminate better views with regard to the management of woods. The Indian government had always been most anxious to help the colonies, and had sent forestry officers to Ceylon, to the Cape, and to Cyprus; but those officers always returned to India because the colonies would not offer them proper terms. The colonies wanted to have men, and to be able to discharge them at their will and pleasure. The Indian government objected to sending away experienced men for the best portion of their working lives, and then to have them return to India in order to be pensioned off. If he were an owner of woods in England under existing conditions, he would probably send his wood bailiff for some time as an apprentice to a shrewd Scotch forester; if there was a school of forestry, he would probably send him to that. A very large quantity of land in Ireland was suitable for woodland; and practically about seven per cent of the land in Scotland was waste land.

THE NEW YORK LEGISLATURE has passed a law for the regulation and control of the practice of veterinary medicine. The law requires the registration of all practitioners, with the evidence of proper qualification afforded by a diploma from some legally incorporated college, or a certificate from an incorporated veterinary society. New York is the first and only state in the union to recognize and protect this profession, as it was the first to establish veterinary schools and to organize a state veterinary society.

IN CONNECTION WITH the article in *Science* of June 18, on a 'Final buffalo-hunt,' it is interesting to note the prospectus of the North-west buffalo-breeding company. This prospectus sets forth that Mr. S. L. Bedson, warden of the Manitoba penitentiary, a few years ago became possessed of a young buffalo-bull and four heifer calves, which have so increased that he now has a herd of eighteen bulls, twenty-five cows, and eighteen calves, all thoroughbred; that, experimenting by crossing with ordinary native cattle, he has found the half-breed possesses largely the characteristics of the thoroughbred, differing only in color, which will make the robe more valuable on account of its novelty; and, further, that, by judiciously crossing the thoroughbred bull with the half-breed cows, he has grown three quarter-

breeds, which closely resemble the buffalo, the head and robes being quite equal, if not superior. Besides the breeding of absolutely thoroughbred buffalo, it is the plan to breed "from selected native or imported Scotch cattle a half-breed that will supply the demand for a perfect buffalo-head; a robe equal in all respects, if not superior, to the best now in the market; and a beef possessing the venison-like taste and nutritious qualities of the pure stock of the plains." The three strong points of the new animal are to be his noble head, his pelt, and his flesh.

AS HAVING A BEARING on the value of the work of the U. S. fish commission, we are glad to give the following figures. The aggregate catch of shad on the Atlantic coast the present year is the largest that has been made since 1872. The Potomac River fisheries show an increase of nearly 100,000 shad over last season. The largest proportion of the catch in the Chesapeake and its tributaries is, however, made by the pound nets in salt or brackish water. The Hudson River was first stocked by the U. S. fish commission with the young of the Atlantic salmon in the spring of 1884. Well-grown sea-run fish weighing from ten to sixteen pounds are being taken at the Troy dam, and there is every reason to expect that the salmon will be permanently established in the Hudson River and its tributaries. The rainbow or California trout which was first introduced on the east coast in 1879, and which has been planted in a number of streams in Pennsylvania, Virginia, Tennessee, Alabama, and North Carolina in the last two or three years, is now being taken by anglers in various localities. Quite a number of specimens have recently been taken in the Holston River in the vicinity of Marion, Va., some of them measuring over eighteen inches in length. This stream was stocked with yearling California trout in the spring of 1884.

PETROLEUM AND NATURAL GAS AS FOUND IN OHIO.

THE introduction of natural gas into Pittsburg and other towns of western Pennsylvania within the last two years, and the marked advantages to manufacturing industries accruing therefrom, have made a great impression on surrounding districts, and especially upon Ohio.

In the last-named state an eager search for the new fuel has been entered upon, and is still going forward at a number of the industrial centres. As a result, many interesting geological facts have been brought to light, some of which have great economic importance. Additions have also been made to our knowledge of petroleum and natural gas. A few of the leading facts that have been established in this connection, and some of the conclusions that seem warranted from them, will be given here.

1. Petroleum and natural gas do not need to be considered apart: they are products of the same strata. Every gas-rock is an oil-rock as well, and all rocks that contain oil contain gas also. These products are often intimately associated in the reservoirs, appearing simultaneously when the rock is pierced by the drill; but in some cases gas only is produced.

When, however, the rock which produces so-called dry gas is followed far enough, it is always found to contain oil as well. Generally the two products are at no great remove from each other. Their separation seems referable to geological structure, as will presently be shown, the gas occupying the higher portions of the common reservoir.

2. The origin of petroleum and gas from organic matter as opposed to the so-called chemical or inorganic theories of their origin, is strongly supported by the facts here furnished. The chemical theories require temperatures high enough to leave ineffaceable marks on the strata from which the petroleum is derived; but no such marks are found in the borings of even the deepest Ohio wells, and some of these wells nearly exhaust the paleozoic scale. There are no igneous intrusions, and no disturbances whatever of the sort that accompany metamorphic action; but from top to bottom the series is normal in all respects, affected only by light dips and low folds.

It is also found that different strata in the same series contain petroleum and gas of different characters: in other words, the character of the product is definitely related to the character of the receptacle and of the strata directly associated therewith.

3. Petroleum exists as such in Ohio rocks. It is actual, and not merely potential. There is no proof that it is now forming. For any thing that appears, the stock contained in the rocks may have been formed contemporaneously with the beds that contain it. There is, it is true, in addition to this petroleum content, a considerable percentage of organic matter in some formations, as in the black shale, which can be converted into gas and oil by destructive distillation, and, so far as we know, by this process alone; but, as shown in the preceding section, there is nothing whatever to lead us to believe that the process of destructive dis-

tillation has ever been applied, least of all that it is being applied, to Ohio rocks. The claim is sometimes made for an agency of manufacture called 'spontaneous distillation;' but, so far as can be seen, this is a human invention, and not a natural process. Instead of furnishing an explanation, it begs the question at issue. Destructive distillation we know, and chemical decomposition, in its various phases, we know; but what is 'spontaneous distillation' as an agency for the formation of petroleum from organic matter?

4. The wide diffusion of petroleum and its derivatives is well illustrated by the facts recently developed in Ohio. It is a mistaken view that these substances are of rare occurrence. Valuable accumulations, of course, are rare, but their presence in measurable quantity is well-nigh universal in the paleozoic rocks of the Mississippi valley. Prof. N. W. Lord, chemist of the Ohio geological survey, has recently examined the black shale of the state with this reference. He finds in normal shale more than two-tenths of one per cent of heavy oil. This amount he has weighed, but, from the nature of the processes he was obliged to use, he is certain that he has not obtained all that was present in the shale. Petroleum as such, or compounds derived from petroleum, as asphaltic grains or films, are also found in all of our principal limestones. Dr. Hunt reported, a number of years ago, more than four per cent of petroleum, or bituminous matter which was undoubtedly derived from petroleum, in the Niagara limestone of Bridgeport, near Chicago. These figures can be duplicated in some phases of the upper Silurian limestones of Ohio.

5. The amount of petroleum stored in the rocks is seen to be enormous. Take the figures of Professor Lord, already quoted. Two-tenths of one per cent of petroleum in a rock represents more than twenty thousand barrels to the square mile for every foot in depth. But the black shale is on its outcrop three hundred feet in thickness, and in the interior the formation is from four to six times as thick. Three hundred feet of shale would contain, to the square mile, six million barrels of petroleum. Suppose the rate given above is too high: divide it by two, by four, by eight, and even the last result would show nearly as much petroleum as has ever been taken from any square mile of the Pennsylvania fields.

6. The old dispute as to whether petroleum is mainly derived from bituminous shales or bituminous limestones has become 'a past issue,' largely through recent developments in Ohio. No question relating to the geology of petroleum has been more warmly or ably discussed. As so often happens, both sides were right in their main affirmations, and both were wrong in what they denied. The petroleum and gas of eastern Ohio, and, by the same token, of western Pennsylvania and New York, are unquestionably derived from the great shale formation of Devonian and subcarboniferous age that underlies this territory, and they are stored in sandstones overlying or interstratified with these shales. The petroleum and gas of north-western Ohio are as certainly derived from good normal Trenton limestone that is at least five hundred feet thick, and underneath which no shales are known to exist.

That the oil and gas of eastern Ohio are derived from the shales, and not from the sandstones in which they are now found, becomes evident from the fact already noted; viz., that the underlying shales always contain a measurable amount of petroleum, while the Berea grit, which is the main Ohio reservoir, is everywhere, in outcrop and under deepest cover, a clean, sharp sandstone, remarkably free from organic remains of all description. *Ex nihilo, nihil fit.* If the source of oil were to be found in a sandstone containing organic remains, the Logan conglomerate (Pocono) should be a much more productive rock than the Berea grit. It is ten times as thick, and several times as coarse, and contains a profusion of sandstone casts of tree-trunks; but it is underlain with light-colored instead of black shale. It is the great salt-water sand of eastern Ohio, and is but rarely petroliferous on any considerable scale.

7. The gas and oil derived from bituminous shales are found to differ in composition, to some extent, from limestone oil and gas. In particular, the latter are never free from small percentages of sulphur compounds, none of which appear in the gas or oil of the shale. These compounds advertise themselves wherever they occur, and make the most noticeable characteristic of these oils.

The composition of Pittsburg gas is reported as very variable, even from the same well. All the observations on the limestone gas of Ohio show it to be remarkably steady and uniform.

Mr. S. A. Ford, chemist of the Edgar Thompson steel-works, gives a number of important facts concerning the composition of Pennsylvania gas in a recent number of the *American manufacturer* (Natural gas supplement, April, 1886). He gives the composition of what he counts average Pittsburg gas, as follows:—

Pittsburg gas.

Hydrogen	22.00
Marsh-gas	67.00
Ethylic hydride	5.00
Olefiant gas	1.00
Nitrogen	3.00
Carbonic acid	0.60
Carbonic oxide	0.60
Oxygen	0.80

The composition of the limestone gas of northwestern Ohio (Findlay gas) is quite different, as appears from the following analysis made by Prof. C. C. Howard of Columbus, for the Ohio survey: —

Findlay gas.

Hydrogen	2 18
Marsh-gas	92.60
Olefiant gas	0.31
Nitrogen	3.01
Carbonic acid	0.50
Carbonic oxide	0.36
Oxygen	0.34
Hydrogen sulphide	0 20

There are 125.8 grains of sulphur in 100 cubic feet of this gas.

Analyses made a year apart show that the constitution of the gas has remained practically unchanged during this interval.

The reference of the gas or oil of shales to limestones, or of the gas or oil of limestones to shales, is seen, in the light of these facts, to be inadmissible. The two series are distinct. These facts also furnish an additional argument against the chemical theory of origin of the petroleum series. Such an origin would seem to insure identity of composition to at least the oils of a single district.

8. Gas and oil are accumulated in more or less porous rocks that act as reservoirs. These reservoirs may be continuous with the source, or they may be distinct. In the case of limestone oil and gas, the first of these conditions is found. The stocks that are held in sandstones come under the second head.

While there are many horizons of gas and oil in Ohio rocks, covering the three main elements of the series, — viz., sandstone, limestone, and shale, — there are two of paramount importance; viz., the Trenton limestone and the Berea grit. The Trenton limestone nowhere rises to the surface in Ohio. It was first discovered to be a storehouse of high-pressure gas at Findlay in November, 1884. It is now yielding both gas and oil in large amount in at least three counties of northern Ohio, — viz., Hancock, Allen, and Wood, — and it promises to become by far the most important source of these products in the state. The section by which it is reached in the productive districts is as follows: —

200′–400′	*Limestone*, upper Silurian	Waterlime. Niagara. Clinton.
800′–1000′	*Shale*, mainly lower Silurian	Medina. Hudson River. Utica.
500′	*Trenton limestone*	Gas and oil accumulated in uppermost beds, often at upper boundary, and never more than 40 feet below.

The main production of this new horizon has, so far, been limited to points where its upper boundary ranges between three hundred and five hundred feet below sea-level. It has been reached in at least a hundred drill-holes within the last year, through a district which would include from eight thousand to ten thousand square miles. The composition is shown by the following analyses of the gas-rock of Findlay and the oil-rock of Lima, which are one and the same thing.

	Findlay.	Lima.
Carbonate of lime	47.05	52.66
Carbonate of magnesia	33.38	37.53
Residue, mainly siliceous	11.73	4.15

The rock is highly crystalline and porous, and the greatest porosity seems to belong to the most productive portions.

The Berea grit becomes petroliferous from the moment that it takes cover. The oil of Mecca and of Grafton is derived almost from the outcrop of the rock. In the first instance, indeed, it has only the bowlder clay for a roof; and, in the second, there are but from forty to sixty feet of Berea and Cuyahoga shale above it. It is only where it descends deeper, however, that it holds large stocks of gas or oil. The lightest cover under which large accumulation has been found in Ohio is six hundred feet, while in the Macksburg field, which is at present the main centre of production from this horizon, the stratum is at least twelve hundred feet below the valley level. The section found here is approximately as follows: —

Coal-measure strata	500′–800′
Conglomerate measures	200′–300′
Logan conglomerate (salt-water sand)	200′
Cuyahoga shale	300′
Berea shale	30′–50′
Berea grit	5′–25′

There are two distinct oil-sands in the coal-measures, and one in the conglomerate group in this section, in addition to the Berea.

These reservoirs, whether sandstone or limestone, are permeable, and often communicate freely through considerable space. The gas-wells of Findlay are quite unequal in production, ranging between one hundred thousand and twelve million cubic feet per day; but when shut in, all show the same pressure. This pressure is now a little less than four hundred pounds to the square inch. It is called the rock-pressure. A large well, when shut in, comes up to this point quickly, and a small well slowly, but all get to the

same point. The flow of the well seems to depend on the porosity of its immediate reservoir. Free communication is also shown in adjacent portions of the Berea grit, but there is nothing to indicate an indefinite or universal permeability. The changes in the grain and thickness of the stratum would naturally divide it into basins approximately distinct from each other.

9. Every oil-rock has a more or less impervious cover, generally fine-grained shale. To constitute an oil-group, three elements are essential; viz., a source, a reservoir, and a cover. The first and second may coalesce, as has been already shown, but the third must be distinct and well-characterized. First in order of importance, as a matter of course, is the source, but so generally is petroleum distributed through the rocks of our scale, that its presence may almost be taken for granted. Practically, the character of the overlying mass is a chief factor. Almost any rock of the Ohio series, if covered by a heavy mass of shale, shows oil or gas when reached by the drill. The Utica, Hudson River, and Medina shales cover the oil-bearing Trenton limestone: the Berea and Cuyahoga shales overlie the petroliferous Berea grit. The corniferous limestone, which is covered by the heavy deposit of the Ohio shale, ought by this order to be also a source of oil. It has been found to be so in Canada, but not yet in Ohio.

10. One other factor is found to be of prime importance in oil and gas production; viz., geological structure. Source, reservoir, and cover may each be complete in itself, and yet no accumulation of either product may result. Illustrations are found in both of the main Ohio horizons.

For many thousand square miles, the relations of the several elements of the series that has proved petroliferous in north-western Ohio are absolutely identical. A hundred wells have now been drilled in this field, and the records of the series traversed are monotonous repetitions of one another. From one you can learn all. Not only is there the same order, the same thickness, the same color, but there is substantially the same chemical constitution of each stratum throughout its entire extent. In all cases there is some accumulation of gas and oil, but generally slight, at the top of the Trenton limestone.

But at one point, as the drill has now shown, in a drift-covered plain, where all the facts were hopelessly obscured to other reading, the steepest dip known in Ohio rocks has been brought to light. Two terraces of Trenton limestone, with their superincumbent strata, are made known to us, one of which is about 310 feet (306, 312, 314) below tide, and the other of which is about 475 feet below. The slope of 165 feet that connects them occupies a little more than a half-mile in breadth. What effect does this marked structural feature seem to have on oil or gas accumulation? On the upper terrace, every well that has been drilled has found a fair supply of gas without oil. The wells of the lower terrace are all oil-wells, though containing considerable gas also. And what of the wells on the slope? That depends on what part of the slope they occupy. On the upper edge, from 330 feet below tide to 350 below, there is a belt of the most remarkable and valuable gas-wells ever struck in the state. The famous Karg well produces, by the lowest measurement, 12,000,000 cubic feet per day. The Trenton limestone was found in it 347 feet below tide. In the next well in order of production, the surface of the limestone was 350 feet, and in the third well 330 feet, below the sea.

Seven wells have been drilled on the slope in which the limestone is between 330 and 350 feet below tide. One of the number is a small producer, but the smallest of the six remaining wells yields more than 1,000,000 cubic feet of gas per day.

Descending the slope still farther, we come to a group of three wells, in which the Trenton limestone lies respectively 394, 403, and 405 feet below tide. All of them were vigorous gas-wells when first drilled, but they also yielded more or less oil from the first. Little by little, however, their character has been changed, oil and salt water overpowering the gas, until now almost their sole value is found in the oil that they produce.

The facts above given come from the Findlay field. Similar facts are found at other centres of production of Trenton oil and gas.

Equally satisfactory testimony as to the all-important influence of structure on gas and oil production is supplied by the facts of the Berea grit. This remarkable stratum, the first persistent sandstone to be reached in ascending the geological scale of the state, has a bold outcrop from the Ohio valley to Lake Erie, and thence eastwards toward Pennsylvania. Scores of quarries are located along this outcrop, from which is derived some of the most valuable building-stone of the country. The stratum dips gently down from its outcrops at the rate of from fifteen to thirty feet to the mile. It holds its continuity underneath the whole of eastern Ohio. Its area in this state, therefore, is not less than twenty thousand square miles. Slight rolls traverse it, breaking up the monotony of its descent. These rolls, or interruptions of dip, connect themselves at once with gas and oil accumulation. A single example, and the one most carefully worked out, must suffice.

In the vicinity of Macksburg, north of Marietta, the light south-eastward dip of the strata is found to be interrupted, and for nearly a mile a terrace-like structure prevails. This is masked, it is true, by the immense erosion which the country has suffered, and only comes into view when the best-known elements of the exposed section as coal-seams are followed by means of the level. All of the strata ever reached by the drill, as well as all that are above the surface, are equally affected by this structural irregularity.

But this terrace is an oil-field, and has been for twenty years. Oil was first found here in shallow wells, from two hundred to three hundred feet deep in the upper Mahoning sandstone. But adventurous drillers, one after another, struck new sources of oil. A second oil-sand, and a third, were discovered at five hundred and seven hundred feet respectively. Finally the drill was sunk deeper still, until, at thirteen hundred feet, the Berea grit was found, holding a stock of oil large enough to make the Macksburg field for the first time a factor in the general market. It has produced as many as three thousand barrels per day since then, and is now yielding twenty-five hundred barrels per day.

But the shallow and the deep productive wells are alike definitely limited to the terrace that has been described. In other words, four oil-sandstones become productive in the same area when the structure is found favorable. That they do not communicate with each other is evident from the fact that the oils which they severally contain differ from each other in gravity, in color, and in chemical constitution.

The depth of the Berea grit below sea-level in the terrace is 735 feet. Of twenty-four wells, occupying four square miles in this field, sixteen reach the Berea between 733 and 737 feet, and six are found by their records to be exactly 735 feet.

On the north-western margin of the terrace, at elevations of 728, 720, 713, and 704 feet, gas is found, but no oil. After many hundred wells have been drilled on all sides, the terrace which has been revealed by the engineer's level is alone found productive.

The grain of the sandstone is in every way as promising, and its thickness as great, outside of the field as within it; and the sections both above and a thousand feet below the Berea grit appear identical in productive and in barren territory alike. It is hard to resist the conclusion that the Macksburg oil-field is dependent upon the structural irregularity here described, the other elements, of course, being presupposed.

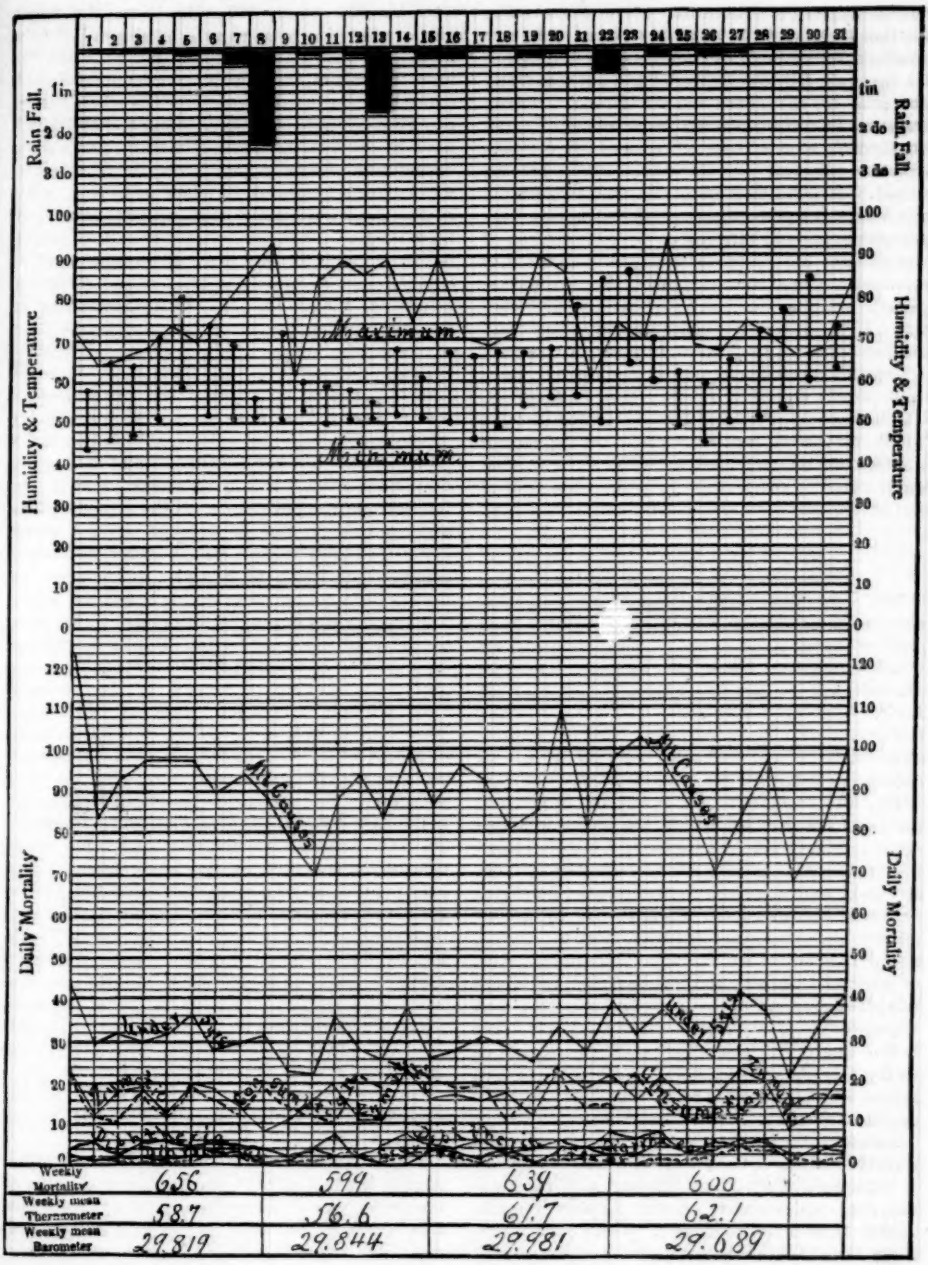
May not a like explanation be applied to the oil and gas fields of Pennsylvania and New York as well? Is it not possible that their productive areas are also dependent on structural disturbance, slight though it may be? These areas have been sometimes explained as resulting mainly from the coarseness of grain of the oil-sands. Lenticular deposits of gravel have been suggested, arranged in north-east and south-west lines for the several petroliferous horizons. It is hard to see how any one of these long tongues of gravel could be accounted for, laid down so far from the shore of the sea in which it was deposited. It is much harder to understand how, as the geological ages went by, one after another of these peculiar deposits should be laid down on these self-same lines. It is certainly much easier to conceive of the oil-sands as wide-spread sheets of sand and gravel, that become the reservoirs of oil and gas when lifted into elementary folds. This is certainly true of the Berea grit in Ohio, and this great stratum, it is now definitely settled, constitutes one of the main oil-sands of Pennsylvania. Under this view, the arrangement of the several oil-fields in north-east and south-west lines becomes easily intelligible. These oil-fields are simply conforming to, as they are determined by, the main structure-lines of western Pennsylvania.

Edward Orton.

THE HEALTH OF NEW YORK DURING MAY.

The population of the city of New York on May 1 was estimated at 1,432,094. Assuming the normal increase to be 799 each week, there would be, June 1, a population of about 1,435,290. Of this number, 2,759 died during the month of May, a mortality less by 206 than occurred during the preceding month. Of children under five years of age, there was a saving of 110 lives as compared with April. The greatest mortality from all causes which occurred during any one day was on the 20th, when 107 persons died. Of this number, 24 were children under one year of age, 29 under two years, and 34 under five years. Consumption caused more deaths on that day, as indeed it usually does on most days of the year, than any other single disease, its victims being 24. The deaths during the month from diarrhoeal diseases were 73, an increase of 16 over the month of April. Diphtheria also caused a considerable increase. its deaths being 165 against 124. Scarlet-fever maintained the same position among the mortality-factors which it had occupied for the two preceding months: the deaths from this disease in March were 42; in April, 49; and in May, 44.

It will be remembered that while rain fell on


Rain Fall.
Humidity & Temperature
Daily Mortality
Maximum
Minimum
Mr Cowell
Weekly Mortality
Weekly mean Thermometer
Weekly mean Barometer
656
594
634
600
58.7
56.6
61.7
62.1
29.819
29.844
29.981
29.689

but few days in the month of April, only seven, yet the aggregate rainfall was about the average for the same month in preceding years. May was in all respects a month of showers: on fourteen of its days rain fell to a greater or less amount; and the total for the month was 5.40 inches. During the same month in 1885, although some rain fell on thirteen days of the thirty-one, but one less day than this year, yet the total rainfall for the month was but 1.86 inches. As will be seen by the chart, the greater part of the rain this year fell on the 8th and 13th insts. An examination of the records for the past seventeen years fails to show such a rainfall during May, the nearest approach being in the year 1882, when 4.20 inches fell. If, however, we continue our search still further back, we shall find a number of years in which this rainfall is surpassed, and in one year, 1846, nearly doubled, it being then 10.25 inches. The highest point reached by the thermometer was 86° F., on the 23d inst., at 5 P.M. On the preceding day the mercury rose to 84° F. at 4 P.M., and on the 30th it reached 85° F. at the same hour of the day.

A NEW EXPEDITION TO ALASKA.

The New York *Times* has sent an exploring expedition to Alaska, the object of which is to explore the St. Elias range of mountains and the country between them and the sea, while an attempt will be made to ascend Mount St. Elias itself. The expedition is led by Lieut. Frederick Schwatka, who has already won deserved renown in arctic travel and research. In 1879 he led an expedition over the route of Sir John Franklin's party, and brought to the world its fullest and final knowledge of the fate of the Erebus and Terror. Again, in 1883, he explored from its source to its mouth Alaska's great river, the Yukon. It was in returning from this trip that Lieutenant Schwatka conceived the desire to visit the mountainous and forbidding southern coast of Alaska, and tell the world something of its Indian races, of its forests, its soil, and its glaciers. The *Times* has given him an opportunity to undertake this voyage of discovery and description, and it hopes in due time to lay before the public such additions to the world's present slight knowledge of this region as will amply justify the effort and the expense involved.

Lieutenant Schwatka himself has an article in a recent number of the *Times*, in which he says: —

"The New York *Times* Alaskan exploring expedition, which sailed on the Alaskan steamer Ancon from Port Townsend, Washington Territory, June 14, has for its object the exploration of the almost wholly unknown St. Elias Alps, stretching for nearly 300 miles from the upper part of that picturesque lane of water called 'the inland passage to Alaska' to Mount St. Elias, the highest peak of the North American continent, and which throws its name over the whole range, and even beyond. The expedition, therefore, will have to do with mountain-climbing; and should opportunity present, which is very likely, attempts will be made to ascend, in whole or in part, some of the numerous peaks that project from that high range. Although, strictly speaking, this is not its main object, still it would be considered no small victory to crown the king of the American continent, Mount St. Elias, with shoe-leather of American make, and, but a little way behind this, to reach the summits of any of the others, — Crillon, Fairweather, La Perouse, Vancouver, Lituya, d'Agelet, — all higher than any peak short of the Rocky Mountain range. Should the top of the main range be gained, at 8,000 to 10,000 feet above sea-level, it is hoped — and the probabilities are great — that a bird's-eye view in the interior will compensate for all the trouble taken, and especially if this be done at several points along the main ridge. Bad weather, of course, could defeat much of this part of the plan, but during the summer months this is not very likely. The interior slopes may be descended if the prospect is at all flattering for important research and discovery of any kind; for toward the interior absolutely nothing is known of the country. Prof. William Libbey, jun., professor of physical geography in Princeton college, will have charge of the scientific work, and especially the hypsometrical and topographical part of it. He has been identified with considerable practical Alpine work in the past, both in our own and other countries. The well known hypsometrical and other scientific tables compiled by the late celebrated Professor Guyot (to whose chair at Princeton Professor Libbey succeeded on the former's death), and published by the Smithsonian institution at Washington, were recently revised under Professor Libbey's care, and brought up to the requirements of scientific advancement in that line since Professor Guyot's death. Many of the hypsometrical and other scientific instruments taken were once those of that celebrated geographer."

Of the scientific aims and prospects of the expedition, Lieutenant Schwatka writes as follows: —

"The glacier system of the Mount St. Elias Alps is undoubtedly the most extensive south of the arctic regions themselves. Just how extended it is cannot be told until further exploration gives more data. It will probably be many years before

it is well outlined, as no one exploration could encompass the whole of it. One bay alone has some six or seven glaciers coming down from the southern spurs of these Alaskan Alps just off the summits of Mounts Fairweather and Crillon, which, dipping into the sea, snap off into icebergs that float away nearly as high as the masts of the excursion steamers that visit this bay — called Glacier Bay — monthly during the spring and summer. From Glacier Bay northward to beyond Icy Bay (just seaward from Mount St. Elias) there can be seen these huge rivers of solid ice coming down to the sea; one, Le Grand Plateau, so named by La Perouse, its discoverer, being probably the largest one of the immense group covering so wide a territory. It is quite evident, if the expedition accomplishes any thing, that no small share of it will be in this particular field of research.

"Between the St. Elias Alps and the sea — the Pacific Ocean — is a narrow strip of flat lands where the Indians live, and which, from the ocean, seems to be heavily wooded. It is proposed to find out the status of this timber and that on the foothills of the Alps, as far as it is possible without spending too much time upon it. If fine forests of merchantable timber are found, which is not at all unlikely, it is known that there are good harbors here which will make it quite accessible, and give value to the discovery. If any thing near as valuable as the present yellow cedar forests of the shores of the inland passage of Alaska can be found, the expedition will be a double success from this very fact.

"In the way of precious minerals there is the usual prospect of seeing them; and while the search for them is probably the last on the list of undertakings, if at all, the party will not go by any mountains of gold or silver without at least taking a photograph of them.

"It is hardly to be hoped that the country is much richer in furs than the general average of the Alaska mainland; but, should it fortunately prove otherwise, the public shall know of it in due time.

"Agriculturally there is little to be expected in such a rough Alpine country; but if the low flats known to exist along the coast are not too marshy, and have fertile soil, there is nothing to prevent their being cultivated to the fullest extent, in which case it would be doubly valuable by there being no other agricultural lands near by.

"Of the Indians living here, but very little is known; and this very fact is somewhat in favor of the expedition, as among these little known savages there is every reason to suppose that a rich ethnological collection can be made, which will not only shed some light on the people themselves, but on adjoining tribes that are somewhat spoiled for ethnological purposes by long contact with white men and civilization."

The exploring party is well supplied with arms and ammunition, as well as with food; and the precise course to be pursued by them is left largely to the discretion of the commander. When the expedition will return depends largely on its success; for Lieutenant Schwatka is determined not to return until he has accomplished something worthy of the expenditure of time and money. He hopes, however, to be back to the Alaskan coast by September of the present year.

ASTRONOMICAL NOTES.

The large dome for the Lick observatory. — At the meeting of the Royal astronomical society on May 14, Mr. Grubb, the well-known Dublin instrument-maker, presented a model of an equatorial mounting and dome which he had designed, at the request of the Lick trustees, for their 36-inch objective. The main idea throughout was to bring under the direct control of the observer all the required motions of the instrument and of the dome, so as to give him as little physical exertion as possible. To effect this the motive power was to be a number of small water-engines, controlled by an electrical apparatus which the observer could carry about with him. A tap on one key will turn the dome in one direction; another will reverse the dome; a third key will control the telescope in right ascension, and another in declination; and so on; while there is one for lighting up the observatory; and lastly, in order that the observer shall have as little difficulty as possible in getting into a position to observe, instead of climbing into a chair which would perhaps require to be twenty-five feet high, a key is provided which will make the whole floor move up or down. During the discussion upon this ingenious device, Mr. Common quoted the following paragraph from Professor Holden in regard to the prospects of completing the observatory: "We hope during the early part of 1887 that we may see the objective, both photographically and visually, completely finished, and perhaps delivered in California. Our large dome will undoubtedly be finished during the current year; and we look forward to commencing serious work with the whole observatory during the year 1887, and possibly sooner." The contracts for the mounting and dome, if any have yet been made by the Lick trustees, are not yet public.

Change of latitude. — Miss Alice Lamb, assistant astronomer at the Washburn observatory, has, in the June number of the *Sidereal messenger*, given

the results of a critical examination of the latitude observations made by army engineer officers at Willets Point during the year 1885. These observations are of peculiar interest from their bearing upon the mooted question of the variability of terrestrial latitudes; but it appears that the sequence of the results from 1880 to 1884, which seemed to indicate a gradual decrease of latitude, is interrupted by the result for 1885, which is practically the same as that for 1881. The conclusion which Miss Lamb reached from a similar discussion of previous observations (*Science*, vi. p. 118) is now further confirmed. The evidence seems to be rather against a systematic change of latitude at Willets Point, though the results for future years will be awaited with interest.

Astronomical activity. — In looking over the reports of observatories for the year 1885, one cannot but be impressed with the increase of activity in all branches of observational astronomy. Greenwich has ordered a 28-inch refractor for spectroscopic work; Struve at Pulkowa, with the new 30-inch, can go deeper than ever into the star depths for faint 'doubles;' the Vienna 27-inch, in the hands of Dr. Vogel, has already done good work in astronomical physics; and Paris has taken the front rank in stellar photography. The interesting report of Admiral Moucher, the director of the Paris observatory, now before us, gives especial prominence to this comparatively new method of research. A reproduction of a photograph of the Pleiades, taken by the Henry Brothers with an exposure of one hour, has suggested a comparison with Wolf's well-known chart of that group, upon which he spent three years' labor, and the advantage of photography in certain directions is strongly brought out. Wolf's chart contains 671 stars, the limit being the 13th magnitude; while the photograph shows no less than 1,421, the faintest being of about the 16th magnitude. In the meridian service over sixteen thousand observations have been made by sixteen different observers; the instrument devised by M. Loewy, the *equatorial coudé*, has been brought into regular use for observations of comets and minor planets; and the time service, meteorological department, etc., are all in a most satisfactory condition. A department of the observatory which we should like to see imitated in this country is the 'Ecole d'astronomie,' in which courses of instruction are given by such members of the observatory staff as Loewy, Tisserand, Gaillot, and Perigaud. The students are given employment in the computing bureau, and, after sufficient instruction, they take part in the observations with the meridian instruments. The schools of astronomy in this country are not very thriving adjuncts of our colleges.

NOTES AND NEWS.

The following appropriations are recommended by the committee on appropriations for the various scientific departments of the government for the fiscal year ending June 30, 1887: — coast survey, $407,246, being $146,250 less than was appropriated the past year; the number of field officers is reduced from 64 to 48; office force, from 103 to 91: geological survey, $467,700, the same amount as was appropriated last year: signal service, $799,493, being $64,587 less than was appropriated last year: national museum, $157,500, $19,000 more than was appropriated last year: Smithsonian institution — international exchange, $10,000; North American ethnology, $40,000; being the same amounts as were appropriated last year: fish commission, $220,040, being $40 more than was appropriated last year.

— The final excursion of the geological class of the Academy of natural sciences of Philadelphia, extending over a period of about ten days, and beginning with the first week in July, will be directed to Nantucket and Martha's Vineyard. It is proposed to investigate the physical (geological and paleontological) features of the islands, and the recent fauna of the coast. The total expense, including the academy admission-fee of seven dollars, will not exceed thirty-five dollars.

— About twenty-five thousand deaths from typhoid-fever occur in this country annually, says the *Medical record*, and this represents fully one hundred and fifty thousand cases of the disease. Statistics show that there is no disease so easily preventable as this; and it is safe to say that fully one-half of this mortality might be saved by greater cleanliness and more attention to sewage.

— A new monthly magazine devoted to the now popular art of photography has just appeared in England under the appropriate title of the *Camera*. Mr. R. A. Proctor supplies an interesting paper on photography and astronomy, with illustrations of some of the recent results of observations; Dr. Lindsay Johnson and Mr. T. C. Hepworth also contribute useful articles; and a descriptive account of the amateur photographic exhibition in Bond Street, with reproductions of some of the principal examples, is carefully written.

— Letters from Colonel Lockhart's mission, dated May 9, have reached India. The party were then near Gumbaz, on the northern slopes of the Hindoo-Koosh. They had gone northward from Gilghit, through Hunza, and would work along the Hindoo-Koosh, and enter Kafristan from the north.

— Dr. Julius Stöckhardt, the well-known agri-

cultural chemist, died at Tharandt, in Saxony, on the 1st of June, in his seventy-seventh year.

— The *Athenaeum* of June 12 states that arrangements are being made for holding an international congress for discussing papers upon climatology, mineral and thermal springs, and allied subjects at Biarritz, under the presidency of Dr. Durand Fardel, the first week in October, to be followed by a three-weeks' tour to the principal watering-places of southern France.

— The *Athenaeum* chronicles the appearance of a new Italian journal of zoölogy, entitled *Bolletino dei musei di zoologia ed anatomia comparata della R università di Torino.* At Jena an *Anatomischer anzeiger*, under the editorship of Prof. K. Bardeleben, is announced to begin its existence this month.

— The following is a list of the publications of the geological survey now in the hands of the public printer: — Sixth annual report of the director: Monographs — Lamellibranchiata of New Jersey, by Whitfield; Dinocerata, by Marsh; Geologic history of Lake Lahontan, by Russell; Geology and mining industry of Leadville, by Emmons; Geology of the Eureka district, by Hague; Lake Bonneville, by Gilbert; Stegosauria, by Marsh: Bulletins — Work done in the division of chemistry and physics, 1884–85, by Clarke; Gabbros and associated hornblende rocks, by George H. Williams; Fresh-water invertebrates of N. A. Jurassic, by C. A. White; Cambrian faunas of N. A., by Walcott; Fossil insects, by Scudder; Mineral springs of the United States, by Peale; Geology of northern California, by Diller; Relation of the Laramie molluscan fauna to succeeding fresh-water eocene, by White; Physical properties of carburets, by Barus and Strouhal; Subsidence of small particles of insoluble solid in liquid, by Barus: A geologic map of the United States.

— Howard Ayers has been appointed as an instructor in zoölogy at Harvard college.

— Under the patronage of the Grand Duke of Baden, and with the concurrence of the grand ducal government, the Industrial society of Karlsruhe, says the Journal of the Society of arts, has organized an international exhibition of the manual arts and domestic economy, to remain open from Aug. 15 to Sept. 15, 1886. The principal object of the exhibition is to make known the best *matériel* and apparatus suitable for small industries, and to popularize their use; so that all small motors, tools, and machine tools will be welcomed.

— An important exhibition of apparatus and implements for the prevention of the diseases of the vine, and for destroying insects that infest it, says the Journal of the Society of arts, was held last month at Conegliano. The exhibiters, who were not limited to Italians, were 197 in number; and of the 524 different machines, apparatus, and implements shown, 450 were connected with application of milk of lime, the most effectual remedy for the disease called peronospora, the proportion being from 8 to 10 of slaked lime to 100 of water. The experiments, made before a jury composed of the most eminent viticulturists and scientific men, which lasted five days, will be described in a report to the minister of agriculture, and will contain a variety of useful information and plates. Three gold medals, three silver with money prize of 150 francs, seven silver ones, and four bronze ones, were awarded, and, besides these, three special premiums were given by the local agricultural committee.

— The following changes have been made in the coast survey service since our last issue: Assistant Gresham Bradford has been ordered to Sandy Hook to make an examination for the location of a permanent self-registering tide-gauge; Lieut. F. S. Carter has been ordered to Baltimore to relieve Lieut. G. H. Peters of the command of the Arago, which has been ordered to New York; Ensign A. W. Dodd has been detached from the schooner Bache, and ordered to the Drift; Assistant J. B. Weir has been ordered to duty at the home office. The following parties engaged in state work have been recalled, owing to the failure, on the part of congress, to appropriate money for the continuance of this field-work: Prof. H. L. Barnard, Chambersburg, Penn.; Prof. A. H. Buchanan, Lebanon, Tenn.; Prof. J. E. Davies, Madison, Wis.; L. A. Bowser, New Brunswick, N. J.; Assistants E. F. Dickins and J. S. Lawson, Anaheim, Cal.; J. L. Campbell, Crawfordsville, Ind.; Prof. Mansfield Merriman, Bethlehem, Penn.

— The following charts will shortly be issued by the coast survey: Cape Flattery to Dixon's Entrance, and from latter point to Cape St. Elias; Head Harbor Island to Petit Manan, coast of Maine; Icy Bay to Semidi Islands, Alaska; topographical sheets of New York and Jersey City water-front from Battery to 68th Street, North River.

— Mr. A. Schuster has recently published (*Phil. mag.*, April, 1886) an analysis of certain observations on the daily variations in earth-magnetism which indicate definitely that the cause of the disturbances lies wholly without the earth.

— According to Professor Heim, says *Ciel et terre*, the total number of glaciers in the Alps is 1,155, of which 249 have a length greater than

four miles and a half (7,500 metres). They are distributed as follows: in France, 144; Italy, 78; Switzerland, 471; Austria, 462. Their total superficial area is between five hundred and a thousand square miles. The longest is the Aletsch glacier in Austria, measuring over nine miles.

— Dr. Freire of Rio de Janeiro, in a letter to the Louisiana state board of health, thus speaks of the results of his inoculation for yellow-fever: "I have performed over seven thousand inoculations with full success. The immunity was almost absolute, notwithstanding the intensity of the epidemic this year. More than three thousand persons who were not inoculated died of yellow-fever; while among the seven thousand inoculated, inhabiting the same infected localities, subject to the same morbid conditions, but seven or eight individuals, whose disease was diagnosed as yellow-fever, died."

— During the year 1885 there were 246 earthquakes, according to the statistics of C. Detaille, as given in the June number of *Astronomie*. The largest number of these, 49, occurred in January; the smallest, 11, in October. For the other months the numbers are as follows: February, 18; March, 15; April, 19; May, 14; June, 29; July, 23; August, 13; September, 16; November, 16. Only 6 are given for North America, as follows: Jan. 12, Washington; Jan. 18, New Hampshire, Carolina; Jan. 26, California; Feb. 5, Virginia; Nov. 19, California.

— A. Raggi has published some observations on the intermittent variation in sound-perception in the human ear, instances of which are probably familiar to many persons. In deep stillness, if one listens to a faintly heard sound, like that of the ticking of a watch, it will be noticed that at irregular intervals the tones are wholly inaudible, while at other times they are distinctly recognized. Mr. Raggi ascertained, by experiments on different persons, that the intervals of silence usually varied between seven and twenty-two seconds; while the periods of sound-perception were between seven and eleven seconds in duration, with a maximum of fifteen. He also found that the variation was not due to extraneous sounds, nor to the blood-circulation or respiration, and concludes that it results from the inability to keep the attention for long periods at a sufficient degree of tension for the perception of faint sounds, or possibly to a variable physiological receptivity in the auditory nerves.

— A legacy of some $75,000 has been left to the Jena university to be applied in zoölogical research on the basis of Darwin's evolution theory. The testator is Herr Paul von Ritter of Basle, who believes the teaching of Darwin to be the greatest sign of progress which the century has yet given.

— According to the statistics recently published by the minister of agriculture and commerce, it appears that the quantity of olive-oil produced last year, in the various provinces throughout Italy, was 52.34 per cent below the average annual yield, which is calculated at 3,405,500 hectolitres (74,921,000 gallons), it being only 1,782,400 hectolitres (39,212,800 gallons); 11 per cent of this total amount was of superior quality, 73 per cent good, and 16 per cent mediocre.

— The Royal academy of medicine of Belgium has recently offered its largest prize ($5,000) for the most meritorious work or paper on the treatment of diseases of the nervous centres, especially for a remedy for epilepsy. The great need of some better means of controlling this last disease induced the academy to offer an additional prize of $1,600 for the best paper on that subject. The prizes are international, and will be awarded in December, 1888.

— Late deep-sea explorations in the Atlantic, carried on under the auspices of the London geographical society, have shown that the ocean-bottom in the northern region is formed of two valleys, of which one, in width, reaches from the tenth degree of east to the thirtieth of west longitude, extending to the equator, at a depth of not less than thirteen thousand feet. The other lies between the thirtieth and fiftieth degrees of west longitude. The mountain-chain separating the two valleys extends northwards towards Iceland, and southward to the Azores, and is of a volcanic character at its ends. Its greatest breadth is a little less than five hundred miles.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Is the ocean surface depressed?

Do barometric observations give any hint regarding the depression of the sea 'at the centre of the oceans'?

If, as is maintained, there be a depression of a thousand metres, the barometer should show about three inches and a half more pressure at the centre of the oceans than at what we ordinarily call sea-level.

Were there any barometric observations made on the islands where the pendulum was swung? or do barometric observations made on any of the oceanic islands cast any light on this subject? I have no authorities at hand to consult, or would not ask the question.

W. H. S.

Candelaria, Nev., May 25.

The notion that there exist in the sea-surface of the earth elevations and depressions amounting to several hundred metres has recently gained a much

wider acceptance than our knowledge of the facts would seem to justify.

Assuming the continents to be simply so much matter, of half the earth's mean density, on the surface of our otherwise closely centrobaric spheroid, it may be shown that individually they will draw the sea-surface up towards their centres by considerable amounts (about a thousand metres at most), leaving corresponding though not equal depressions opposite those centres; and that collectively they will produce a wavy sea-surface, in which the maximum radial distance from crest to hollow is about six hundred metres. The theory, and the equations assigning the form and position of this wavy surface, have been developed by Helmert in his excellent treatise on geodesy ('Die mathematischen und physikalischen theorieen der höheren geodäsie'), from which the above figures have been taken. If we dropped our examination of the question at this point, we might infer the reality of the wavy surface just described. The existence of such assumed continents, however, implies a proportionate variation of gravity along the sea-surface and along the same level surface extended through the continents. They would, for the most part, produce an excess of gravity over the continental and a deficiency over the sea areas. But this conclusion is in direct contradiction with the results of pendulum experiments. The assumption, therefore, that the continents are superficial masses, unbalanced in their attractive effects, is, as clearly shown by Helmert, inadequate, and must, together with the conclusions based thereon, be modified or rejected.

Some writers, notably Fischer and Listing, have proved the existence of a highly irregular sea-surface by a still more unsound process than that indicated above would be if we neglected to examine its fundamental assumption. This process, in brief, rejects in an equation a term of the same order as those retained, and arrives at a simple relation between the variation of gravity and the radial distance from the actual sea-surface (or geoid) to the mean spheroidal surface. Helmert fitly characterizes this relation as entirely worthless (*ganz wertlos*), since it fails in every case to give the proper sign when the increments of gravity and radial distance due to the combined action of the continents are substituted in it.

Those desiring to examine minutely the merits of this question should consult the above-named treatise of Helmert, who gives a critical review of the cognate works of Fischer, Listing, Bruns, and others. For the benefit of the general reader, it may be stated, that, although the sea-surface is undoubtedly somewhat irregular, geodesy and geology have as yet furnished no adequate evidence of irregularities amounting to more than ten metres. Additional information, of which it must be admitted there is great need, may disclose the existence of a surface having hills and hollows separated by an interval of fifty or possibly a hundred metres; but irregularities of any greater extent appear to be quite improbable.

The suggestion of your correspondent, that the barometer would indicate any large elevations or depressions in the sea-surface, is not well grounded. The surfaces of equal pressure in the atmosphere must approximate to parallelism with the sea-surface, however irregular it may be. In a state of quiescence the air-surface in contact with the sea is necessarily a surface of equal pressure. The barometer would therefore, if moved from one point to another along the sea-surface, register only such variations in pressure as are due to changes of temperature, winds, etc., and hence afford no indication of the elevations and depressions in question, if they exist.

R. S. WOODWARD.

Washington, D.C., June 17.

Barometer exposure.

Mr. Clayton's letter concerning the influence of wind on the indication of the barometer broaches a subject of great importance to theoretic and practical meteorology, and I trust it may lead to the execution of the experiments essential to the intelligent treatment of the difficulty. As his conclusions are called in question by President LeConte, I take the liberty of rehearsing some investigations of my own which tend to sustain Mr. Clayton's conclusions.

In June, 1873, an elaborate series of synchronous barometric observations were made by the signal office at four stations on the summit and slope of Mount Washington. In testing a special method of barometric hypsometry, I had occasion to discuss these observations, and I discovered an important anomaly which was correlated with the velocity and direction of the wind. The discussion cannot be repeated here, for lack of space; but it may be said that its method and material were such as to leave no reasonable doubt that the wind was the disturbing factor, while they afforded quantitative results far more precise than can be reached by any method of reduction to sea-level. The reader who cares to examine them should consult the 'Second annual report of the U. S. geological survey,' pp. 521–534 and 562–565. One of the specific conclusions was, that a northwest wind of fifty miles per hour, by drawing air out of the summit observatory, presumably through the chimney, caused the mercury in the barometer to stand .13 of an inch too low; and it was estimated that a wind-velocity of a hundred miles would lower the mercury more than half an inch.

I think President LeConte is mistaken in supposing that the matter could be simply tested by comparing the indications of a barometer in a room with those of a barometer out of doors. If the out-of-door barometer were placed on the windward side of a building or other obstruction, and close to it, it would be immersed in compressed air, and read too high. If placed under the lee of an obstruction, it would be surrounded by relatively rarified air, and read too low. If placed in a position uninfluenced by obstructions, the locus of difficulty would be transferred from the surrounding atmosphere to the instrument itself, for the air chamber above the mercury in the cistern of the barometer would itself be influenced by the wind so as to receive a tension abnormally high or low. These statements, based on familiar physical laws, are not individually susceptible of ready verification, because, while the wind blows, all local tensions are disturbed, and we have no standard air-pressure for comparison. I have, however, determined experimentally that the reading is higher in front of an obstruction than behind it. A difference of .15 of an inch was found between barometer-readings on opposite sides of the apex of an acute mountain-peak.

In my opinion, the proper method of escaping the difficulty is, not to place the barometer out of doors, where observation during a wind is itself a matter

of difficulty, but to so arrange the observatory that the influence of the wind shall be either measured and subtracted, or avoided altogether. Place the barometer in an air-tight box, made partly of glass for purposes of observation, and connect this box by a tube with an opening on the roof so adjusted that it shall always sustain the same relation to the wind. It is possible that a form of opening can be devised such that the wind will neither compress nor dilate the air within the box; but, if this cannot be done, it is certainly possible, by a proper system of experiments, to determine for a given arrangement of aperture the proper correction to apply to the barometer-reading for each measured velocity of wind. The matter should receive thorough investigation.

G. K. Gilbert.

Washington, June 19.

I infer from Prof. John LeConte's letter in your last issue (*Science*, vol. vii. p. 550) that he does not feel entirely satisfied with the explanation I have offered of the slight fluctuations of the barograph observed at Blue Hill during high winds. He says, "The observed facts are, that fluctuations of wind-velocity correspond with fluctuations of air-pressure. In some cases it may be difficult to decide which is cause, and which is effect." In this case, the fact, as stated in my last letter, that I could produce these fluctuations at will by merely opening and closing a hatchway in the top of the building, seems to me to prove conclusively that the wind was the cause, and the change in the pressure the effect. In regard to his suggestion that a comparison should be made between a barograph inside and one outside of the building, I think, before satisfactory results could be obtained, it would first have to be proven that the wind in blowing across the top of the barometer cistern, or at right angles to the crevices of such cistern, would not have the same effect of lowering the readings of the barometer outside as well as inside of the building.

Mr. E. B. Weston of Providence has informed me that he has noticed during high winds small oscillations of his barograph, similar to those observed at Blue Hill, and has prevented them by opening the windows, so as to give a free draught of air. I tried the same at Blue Hill during a late high wind, and found that the oscillations, which at most were slight, were reduced by it.

In regard to those large differences between the observed and estimated pressure on Mount Washington, referred to in my last as collected by Professor Loomis, it is probable, that, in these extreme cases, other causes than that suggested by me become factors in the result; such, for instance, as a lagging of the time of minimum pressure at the top as compared with the base, and a more violent cyclonic circulation of the wind at that height, — causes which have been suggested by Professor Loomis in his twentieth paper (*Amer. journ. sc.*, vol. xxviii. July, 1884).

H. Helm Clayton.

Blue Hill meteor. observ., June 19.

A most extraordinary structure.

Referring to P.Z.S. 1885, p. 908, pl. lxi. fig. 3, *h*, where my amiable young friend Dr. Shufeldt describes and figures the humerus of a humming-bird as 'a most extraordinary structure,' I may be permitted to suggest that some of the alleged 'eccentricities' of this 'unique' bone might seem less if he had not got the bone turned hind part before by one of those strokes of genius which a prosaic world, steeped in materialism, is slow to appreciate.

A Theosophist.

Smithsonian Institution,
Washington, June 15.

Aspects of the economic discussion.

I have just read Professor Newcomb's article (*Science*, vii. No. 176) on the new school of political economy. It seems to me that the professor asks for too much in the way of results from the new school. As I understand it, this is simply a question of methods. The new school professes the historical method, as opposed to the deductive method of the so-called orthodox school. If the historical method is right, the results eventually arrived at will, nay must, be right. But to stop them on their way as if with a revolver, and demand a categorical statement of their views on such disputed points as state interference before they are allowed to finish their journey, is certainly unwarranted.

Whatever results the new school may reach, it is tolerably certain that they will eliminate from the books that monster of imagination the 'economic man,' and that other *chimaera bombans in vacuo*, the hypothetical 'consumer,' who does nothing in this world but eat.

When they shall have rebuilt the science on their new foundation, it will be soon enough to demand from them an account of their views on such questions as Professor Newcomb propounds.

Wm. A. Ingham.

333 S. 16th St., Philadelphia, June 18.

Distribution of colors in the animal kingdom.

In the notice of Camerano's 'Distribution of colors in the animal kingdom' (*Science*, vii. p. 557) I notice the astonishing statement that green 'never occurs among mollusks.' On the contrary, it is one of the most common colors of mollusks, especially among fresh-water species. Examples will occur to the most superficial observer in the genera Anodonta, Unio, Campeloma, Anculotus, etc. Among land-shells the arboreal helices of tropical countries are noted for their magnificent greens. Among marine shells, it is notable in many species of Mytilus, Modiola, Tellina, Prasina, etc., among pelecypods; Neritina, Chlorostoma, Turbo (where the calcareous operculum, also, is often stained with green), Haminea, and many other gastropods; not to speak of the nudibranchs, which frequently exhibit different shades of green. The rarest color among mollusks is pure blue (as distinguished from the rather common bluish violet), but even this color is found of great brilliancy in some cases. The assertion objected to is one more bit of evidence to the general neglect among biologists, otherwise well equipped, to gain any general knowledge of the Mollusca, except that supposed to be afforded by theoretical views taken from out worn text-books. There are perhaps a dozen first-class general conchologists in the world, none of whom are young. The prospect now is that the next generation will not have any. The reasons seem to be, among others, the shocking state into which amateurs and superficial students have brought the nomenclature, and the fact that the scientific training to be had in our best colleges leads in altogether different directions.

Wm. H. Dall.